

*Nyctosaurus* was a mid-sized pterosaur that lived along the shores of the Niobrara Formation of the United States, which back then was within a large inland sea called the Western Interior Seaway. It has been suggested that it would have flown similar to modern-day soaring birds such as albatrosses, which consisted of flying very long distances and rarely flapping.<sup>[2]</sup> The species *N. gracilis* and *N. nanus* have previously been considered as species of the closely related *Pteranodon*, back then known as *P. gracilis* and *P. nanus*, due to their similarities.

## Synonyms

## Discovery and species



Juvenile *N. gracilis* specimen at the Field Museum, Williston's IL P. 25026

The first *Nyctosaurus* fossils were described in 1876 by Othniel Charles Marsh, based on fragmentary material, holotype YPM 1178, from the Smoky Hill River site in Kansas. Marsh referred the specimen to a species of his new genus *Pteranodon*, as *Pteranodon gracilis*.<sup>[3]</sup>

Later that year, Marsh reclassified the species in its own genus, which he named *Nyctosaurus*, meaning "night lizard" or "bat lizard", in reference to the wing structure somewhat paralleling those of bats.<sup>[4]</sup> In 1881, Marsh incorrectly assumed the name was preoccupied and changed it into *Nyctodactylus*, which thus is now a junior synonym.<sup>[5]</sup> In 1902, Samuel Wendell Williston described the most complete skeleton then known (P 25026) discovered in 1901 by H. T. Martin. In 1903, Williston named a second species, *N. leptodactylus*, but this is today considered identical to *N. gracilis*.

In 1953, Brazilian paleontologist Llewellyn Ivor Price named a partial humerus, DGM 238-R found in Brazil, *N. lamegoi*; the specific name honours the geologist Alberto Ribeiro Lamego. This species has an estimated wingspan of four metres; today, it is generally considered to be a form different from *Nyctosaurus*, but has not yet been assigned its own genus name.<sup>[1][6][7]</sup>

In 1972, a new skeleton, FHSM VP-2148, in 1962 discovered by George Fryer Sternberg, was named *N. bonneri*; today, it is generally seen as identical to *N. gracilis*.<sup>[1]</sup>

In 1978, Gregory Brown prepared the most complete *Nyctosaurus* skeleton currently known, UNSM 93000, which was based upon the related and larger nyctosaurid *Alcione elainus*.<sup>[8]</sup>

In 1984, Robert Milton Schoch renamed *Pteranodon nanus* (Marsh 1881), "the dwarf", *Nyctosaurus nanus*.<sup>[5]</sup> The question of this species validity is currently pending further study.<sup>[1]</sup>

In the early 2000s, Kenneth Jenkins of Ellis, Kansas collected two specimens of *Nyctosaurus*, which were the first to demonstrate conclusively that not only was this species crested, but that the crest in mature specimens was very large and elaborate. The specimens were purchased by a private collector in Austin, Texas. Despite being in private hands rather than a museum collection, paleontologist Chris Bennett was able to study the specimens and gave them the manuscript reference numbers KJ1 and KJ2 (for Kenneth Jenkins). Bennett published a description of the specimens in 2003. Despite the unusual crests, the specimens were otherwise

### Genus synonymy

- *Pteranodon (Nyctosaurus)* (Marsh, 1876)
- *Nyctodactylus* Marsh, 1881

### Synonyms of *N. gracilis*

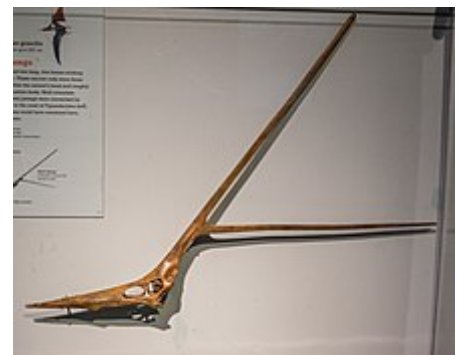
- *Pteranodon gracilis* Marsh, 1876
- *Pteranodon (Nyctosaurus) gracilis* (Marsh, 1876)
- *Nyctodactylus gracilis* (Marsh, 1876)
- *Nyctosaurus leptodactylus* Williston, 1903

### Synonyms of *N. nanus*

- *Pteranodon nanus* Marsh, 1881

### Synonyms of *N. bonneri*

- *Pteranodon bonneri* Miller, 1972
- *Pteranodon (Nyctosaurus) bonneri* (Miller, 1972)



Cast of the skull with an elongated crest

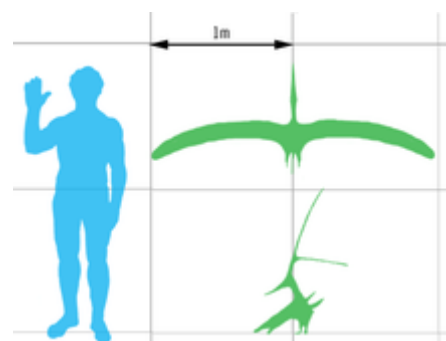
indistinguishable from other specimens of *Nyctosaurus*. However, the then-currently named species were extremely similar and Bennett declined to refer them to a specific one pending further study of the differences, or lack thereof, between species of *Nyctosaurus*.<sup>[1]</sup>

## Description

---

### Size and weight

*Nyctosaurus* was similar in anatomy to its close relative and contemporary, *Pteranodon*. It had relatively long wings, similar in shape to modern seabirds. However, it was smaller overall than *Pteranodon*, with an adult wingspan of 2 meters (6.6 ft) and a maximum weight of about 1.86 kg.<sup>[1]</sup> Some wingspan estimates by German paleontologist Peter Wellnhofer in 1991 however, reached a total of about 2.9 meters (9.5 ft), and the dubious species "*N.*" *lamagoi* had a wingspan estimate of around 4 meters (13 ft) according to Price back in 1953.<sup>[9]</sup> The overall body length was estimated to have been about 37 centimeters (1.21 ft).<sup>[10]</sup>



Size of a mature, crested specimen (green) compared with a human

### Skull and beak

Some skull specimens preserve a distinctively large crest, at least 55 centimeters (1.80 ft) tall in the older adults, and was relatively gigantic compared to the rest of the body, while also being over three times the length of the head. The crest is composed of two long, grooved spars, one pointed upward and the other backward, arising from a common base projecting up and back from the back of the skull. The two spars were nearly equal in length, and both were nearly as long or longer than the total length of the body. The upward-pointing crest spar was at least 42 centimeters (1.38 ft) long and the backward-pointing spar was at least 32 centimeters (1.05 ft) long.<sup>[1]</sup>

The jaws of *Nyctosaurus* were long and extremely pointed. The jaw tips were thin and needle sharp, and are often broken off in fossil specimens, giving the appearance that one jaw is longer than the other, though in life they were probably equal in length.<sup>[1]</sup>

### Wings

*Nyctosaurus* had wings very similar in built to those of its relative *Pteranodon*, which have a high aspect ratio and low wing loadings. The wing structure generally resembles that of the modern-day albatross, and therefore also flew like it. Unlike the related *Pteranodon* however, *Nyctosaurus* was much smaller in size, and had a relatively shorter wingspan, though still large compared to earlier pterosaurs.<sup>[9][1]</sup>



Diagram of the skeleton of *Nyctosaurus* depicted without a crest

### Forelimbs

Like the closely related *Pteranodon*, *Nyctosaurus* also had relatively long forelimbs compared to other earlier genera. Most of the tendons of the upper arm and forearm were mineralized within, this is a unique feature only seen in nyctosaurids, another of which was the related *Muzquizopteryx*. Another distinctive feature seen

in *Nyctosaurus* was that it only had three phalanges instead of four, as seen in other pterodactyls, this trait is rarely seen in other pterosaurs, and perhaps may have been an autapomorphy only found in *Nyctosaurus*.<sup>[11]</sup>

*Nyctosaurus* had unusually elongated metacarpals which measured about 2.5 times the length of its humerus. Proportions such as these can only be seen in two other groups pterosaurs: the pteranodontids and the azhdarchids. Another feature that *Nyctosaurus* had in common with *Pteranodon* was its wing fingers, which occupied about 55 percent of the whole wing.<sup>[11]</sup>

Studies on *Nyctosaurus* anatomy have concluded that the first, second and third metacarpals of have lost contact with the carpus, similar to pteranodontids, but unlike them, *Nyctosaurus*, and possibly other nyctosaurids, had also lost the corresponding digits except the "flight" digit.<sup>[11]</sup> As a result, it was likely to have impaired its movement on the ground, leading scientists to conjecture that it spent almost all of its time on the wing and rarely landed. In particular, the lack of claws with which to grip surfaces would have made climbing or clinging to cliffs and tree trunks impossible for *Nyctosaurus*.<sup>[1]</sup>

## Hindlimbs

Contrary to its elongated forelimbs, *Nyctosaurus* had proportionally short hindlimbs compared to the overall body size. Analyses show that *Nyctosaurus* had the shortest hindlimbs of any pterosaur genera, in terms of hindlimb-to-body ratio, which was only about 16 percent the size of its wing.<sup>[11]</sup>

## Classification

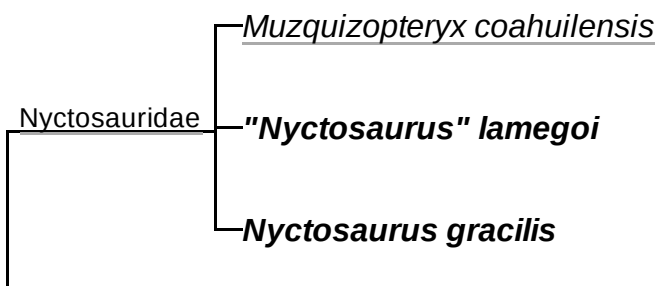
---

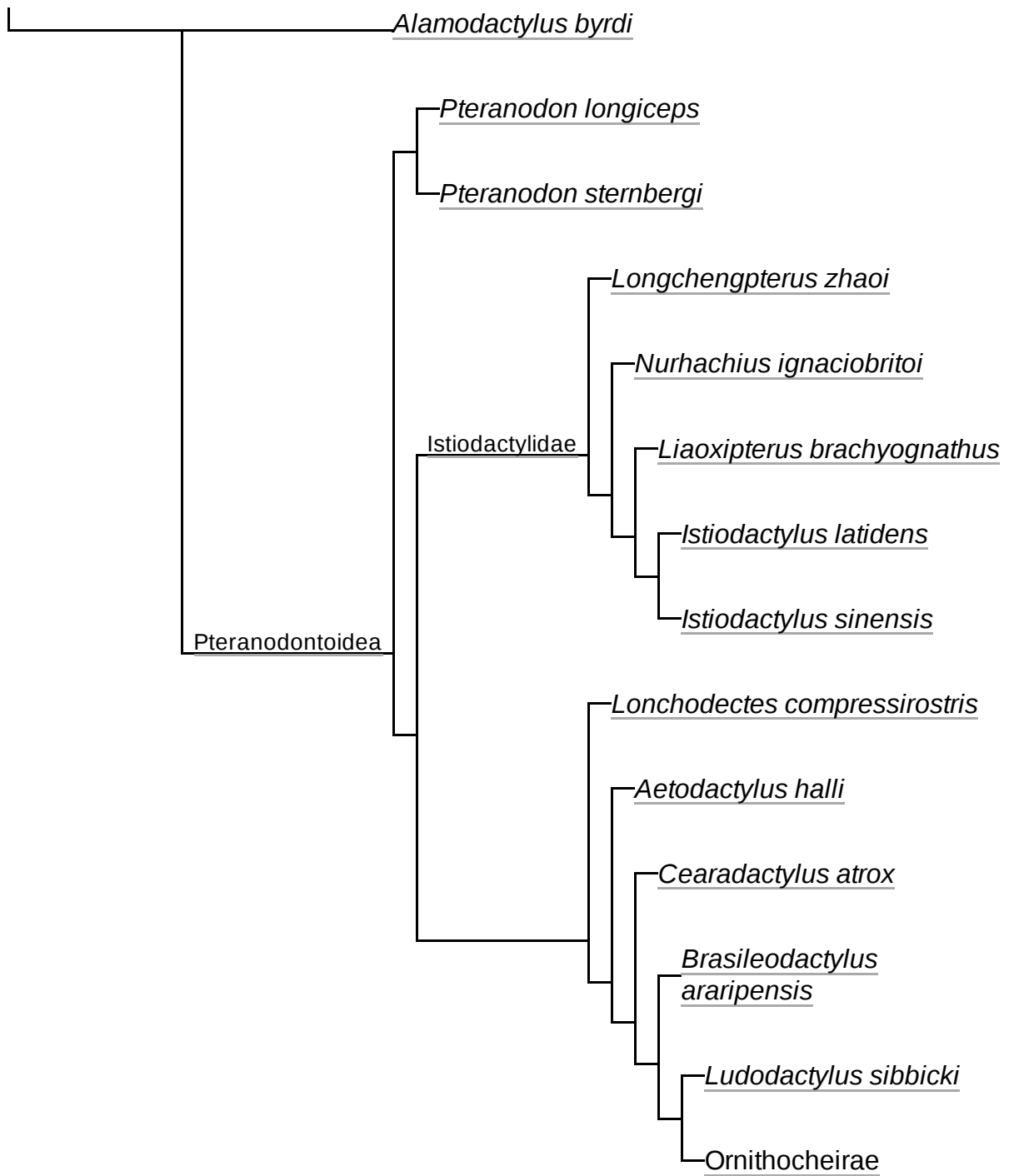
Below is a cladogram following Andres and Myers (2013), and showing the phylogenetic placement of this genus within the clade Pteranodontia. The two better known species of *Nyctosaurus* (*N. gracilis* and "*N. lamagoi*") were placed within the family Nyctosauridae, as sister taxa of *Muzquizopteryx*.<sup>[12]</sup>



Drawing of *Nyctosaurus* in a quadrupedal walking position

### Pteranodontia





## Paleobiology

### Life history

*Nyctosaurus*, like its relative *Pteranodon*, appears to have grown very rapidly after hatching. Fully adult specimens are no larger than some immature specimens such as P 25026 (pictured below), indicating that *Nyctosaurus* went from hatching to adult size (with wingspans of 2 meters or more) in under a year. Some sub-adult specimens have been preserved with their skulls in nearly pristine condition, and lack any trace of a head crest, indicating that the distinctively large crest only began to develop after the first year of life. The crest may have continued to grow more elaborate as the animal aged, though no studies have examined the age of the fully adult, large-crested specimens. These individuals may have been 5 or even 10 years old at the time of their deaths.<sup>[1]</sup>

## Crest function



Restoration of a crested specimen

Only five relatively complete *Nyctosaurus* skulls have been found. Of those, one is juvenile and does not possess a crest (specimen FMNH P 25026), and two are more mature and may show signs of having had a crest but are too badly crushed to say for sure (FHSM 2148 and CM 11422). Two specimens (KJ1 and KJ2) described in 2003, however, preserved an enormous double-pronged crest.<sup>[1]</sup>



Artist's impression of a crested specimen

A few scientists had initially hypothesized that this crest, which resembles an enormous antler, may have supported a skin "headsail" used for stability in flight. While there is no fossil evidence for such a sail, studies have shown that a membranous attachment to the bony crest would have imparted aerodynamic advantages.<sup>[2]</sup> However, in the actual description of the fossils, paleontologist Christopher Bennett argued against the possibility of a membrane or soft tissue extension to the crest. Bennett noted that the edges of each prong were smooth and rounded, and showed no evidence for any soft-tissue attachment points. He also compared *Nyctosaurus* with large-crested tapejarids, which do preserve soft tissue extensions supported by prongs, and showed that, in those species, the attachment points were obvious, with jagged edges where the transition from bone to soft tissue occurred. Bennett concluded that the crest was most likely used solely for display, citing similar structures in modern animals.<sup>[1]</sup> The 2009 study by Xing and colleagues testing the aerodynamics of the giant crest with a "headsail" also tested the aerodynamics of the same crest with no sail, and found that it added no significant negative factors, so a crest with no headsail would not have hindered normal flight.<sup>[2]</sup> It is more likely that the crest acted mainly for display, and that any aerodynamic effects it may have had were secondary. Bennett also argued that the crest was probably not a sexually dimorphic character, as in most crested pterosaurs, including the related *Pteranodon*, both sexes are crested and it is only the size and shape of the crest that differs. The apparently non-crested *Nyctosaurus* specimens therefore probably came from sub-adults.<sup>[1]</sup>

## Wing loading and speed

Researchers Sankar Chatterjee and R.J. Templin used estimates based on complete *Nyctosaurus* specimens to determine weight and total wing area, and to calculate its total wing loading. They also estimated its total available flight power based on estimated musculature. Using these calculations, they estimated the cruising speed of *Nyctosaurus gracilis* as 9.6 meters/second (34.5 kilometers/hour or 21.4 miles/hour).<sup>[10]</sup>

## Paleoecology

All known *Nyctosaurus* fossils come from the Smoky Hill Chalk of Kansas, part of the Niobrara Formation. Specifically, they are found only within a narrow zone characterised by the abundance of ammonite fossils belonging to the species *Spinptychus sternbergi*. These limestone deposits were laid down during a marine regression of the Western Interior Seaway that lasted between 85 and 84.5 million years ago. Therefore, *Nyctosaurus* was a relatively short-lived species, unlike its relative *Pteranodon*, which is found throughout almost all of the Niobrara layers into the overlying Pierre Shale Formation, and existed between 88 and 80.5 million years ago.<sup>[13]</sup>



The ecosystem preserved in this zone was unique in its abundance of vertebrate life. *Nyctosaurus* shared the sky with the bird *Ichthyornis* and with *Pteranodon longiceps*, though the second Niobrara *Pteranodon* species, *P. sternbergi*, had disappeared from the fossil record by this point. In the waters of the Western Interior Seaway below swam mosasaurs such as *Clidastes*, *Ectenosaurus*, *Eonator*, *Halisaurus*, *Platecarpus* and *Tylosaurus*, several remains of the plesiosaurs *Dolichorhynchops* and *Polycotylus*, cephalopods like *Baculites* and *Tusoteuthis*, and the sea turtles such as *Ctenochelys* and *Toxochelys* were also found. Flightless diving birds such as *Ichthyornis* and *Parahesterornis* were also known from the fossil site, a wide variety of fish including swordfish-like *Protosphyraena*, as well as the predatory fishes *Pachyrhizodus*, *Xiphactinus*, *Ichthyodectes*, *Gillicus*, *Leptecodon*, *Enchodus* and *Cimolichthys*, the filter feeding *Bonnerichthys*, the dorsal finned *Bananogmius*, and the cartilaginous fishes *Cretolamna*, *Ptychodus*, *Rhinobatos* and *Squalicorax* were also found within the formation.<sup>[13]</sup> Several dinosaur genera were found along with *Nyctosaurus* remains, these included the nodosaurids *Hierosaurus* and *Niobrarasaurus*, as well as the hadrosaur *Claosaurus*.<sup>[14]</sup>



Map of North America during the mid-Cretaceous period, illustrating the Western Interior Seaway

## See also

- List of pterosaur genera
- Timeline of pterosaur research

## References

- Bennett, S.C. (2003). "'New crested specimens of the Late Cretaceous pterosaur *Nyctosaurus*.'" (<https://link.springer.com/article/10.1007/BF03004560>). *Paläontologische Zeitschrift*. **77**: 61–75..
- Xing, L., Wu, J., Lu, Y., Lu, J., and Ji, Q. (2009). "Aerodynamic characteristics of the crest with membrane attachment on Cretaceous pterodactyloid *Nyctosaurus*" ([https://www.researchgate.net/publication/229502318\\_Aerodynamic\\_Characteristics\\_of\\_the\\_Crest\\_with\\_Membrane\\_Attachment\\_on\\_Cretaceous\\_Pterodactyloid\\_Nyctosaurus](https://www.researchgate.net/publication/229502318_Aerodynamic_Characteristics_of_the_Crest_with_Membrane_Attachment_on_Cretaceous_Pterodactyloid_Nyctosaurus)). *Acta Geologica Sinica*. **83** (1): 25–32.
- Marsh, O.C. (1876a). "Notice of a new sub-order of Pterosauria." *American Journal of Science*, **11**(3): 507-509.
- Marsh, O.C. (1876b). "Principal characters of American pterodactyls." *American Journal of Science*, **12**: 479-480.
- Marsh, O.C. (1881). "Note on American pterodactyls." *American Journal of Science*, **21**: 342-343.
- Price, Llewellyn Ivor (1953). "A presença de Pterosauria no Cretáceo Superior do Estado da Paraíba". *Notas Preliminares e Estudos, Divisão de Geologia e Mineralogia, Brasil* (71): 1–10.
- Kellner, Alexander Wilhelm Armin (1989). "Os répteis voadores do cretáceo brasileiro" ([https://web.archive.org/web/20131202223715/http://ppegeo.igc.usp.br/scielo.php?script=sci\\_pdf&pid=S0101-97591989000100011&lng=es&nrm=iso&tlng=pt](https://web.archive.org/web/20131202223715/http://ppegeo.igc.usp.br/scielo.php?script=sci_pdf&pid=S0101-97591989000100011&lng=es&nrm=iso&tlng=pt)). *Anuário do Instituto de Geociências*. **12**: 86–106. Archived from the original ([http://ppegeo.igc.usp.br/scielo.php?script=sci\\_pdf&pid=S0101-97591989000100011&lng=es&nrm=iso&tlng=pt](http://ppegeo.igc.usp.br/scielo.php?script=sci_pdf&pid=S0101-97591989000100011&lng=es&nrm=iso&tlng=pt)) on 2 December 2013. Retrieved 24 November 2013.

8. Brown GW (1978) Preliminary report on an articulated specimen of *Pteranodon* (*Nyctosaurus*) *gracilis*. Proceedings of the Nebraska Academy of Science 88: 39.
9. Witton 2013, p. 177.
10. Chatterjee, S. and Templin, R.J. (2004). *Posture, Locomotion, and Paleoecology of Pterosaurs*. Geological Society of America, 64 pp. ISBN 0-8137-2376-0, ISBN 978-0-8137-2376-1
11. Witton 2013, p. 179.
12. Andres, B.; Myers, T. S. (2013). "Lone Star Pterosaurs". *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*: 1. doi:10.1017/S1755691013000303 (<https://doi.org/10.1017/S1755691013000303>).
13. Carpenter, K. (2003). "Vertebrate Biostratigraphy of the Smoky Hill Chalk (Niobrara Formation) and the Sharon Springs Member (Pierre Shale)." *High-Resolution Approaches in Stratigraphic Paleontology*, 21: 421-437. doi:10.1007/978-1-4020-9053-0 (<https://doi.org/10.1007/978-1-4020-9053-0>)
14. K. Carpenter, D. W. Dilkes, and D. B. Weishampel. 1995. The dinosaurs of the Niobrara Chalk Formation (Upper Cretaceous, Kansas). *Journal of Vertebrate Paleontology* 15(2):275-297

## Further reading

---

- Witton, Mark (2013). *Pterosaurs: Natural History, Evolution, Anatomy*. Princeton University Press. ISBN 978-0691150611.

## External links

---

- Nyctosauridae (scroll down) (<https://web.archive.org/web/20070322195214/http://www.pterosaur.co.uk/species/UCP/UCP.htm>) in The Pterosaur Database
- 

Retrieved from "<https://en.wikipedia.org/w/index.php?title=Nyctosaurus&oldid=967153660>"

---

**This page was last edited on 11 July 2020, at 13:05 (UTC).**

Text is available under the Creative Commons Attribution-ShareAlike License; additional terms may apply. By using this site, you agree to the [Terms of Use](#) and [Privacy Policy](#). Wikipedia® is a registered trademark of the [Wikimedia Foundation, Inc.](#), a non-profit organization.